Glutamic acid racemization rate is lower than the aspartic acid one and after 1600 hours of heating only 0.6 racemization ratio was reached.

Amino acids racemization kinetics in bear teeth dentine. Application to pleistocene fossil bear aminochronology

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Fossil bear remains are very common in the Pleistocene and Holocene palaeontological record of Europe but in spite of that large amounts of bone and tooth remains were found, their dating is still problematic because they are out of ^{14}C dating method range, and bone and dentine are open systems that make unreliable U-series dating method use. Recently the Electro Spin Resonance Dating Method has been employed with promissory results.

The Biomolecular Stratigraphy Laboratory of the Madrid School of Mines has been analyzing amino acid racemization in bear tooth dentine since 1993 but the former results were erratic because of the complexity of the collagen derived protein chains, polipeptides, dipeptides and free amino acids racemization rates. With a 3,500 Dalton membrane dialysis use we have been able to obtain homogeneous results being possible to establish two fossil bear aminozones: the former is the Middle Pleistocene *Ursus deningeri* (ca. 300 ka B. P.) and the latter the Upper Pleistocene *Ursus spelaeus* (between 100 and 25 ka B.P.). In some cases bear remains are hominid associated.

In order to estimate absolute ages and paleotemperatures of fossil bears and to approach the kinetic equation of aspartic acid and glutamic acid racemization we have exposed modern bear *(Ursus americanus)* dentine samples to elevated temperatures in a stove in sealed tubes with inert (N_2) atmosphere. Ultra clean water and ultra clean quartz sand were added.

The results of our kinetics heating experiments, after sample 3,500 Dalton dialysis, show that there is an excellent time-aspartic acid correlation, also being possible to observe the "apparent kinetics reversal" also observed in heating experiments on mollusca samples.

Aspartic acid racemization constant when we adjust to a first order reversible kinetics ecuation:

$2k_L t = C + \ln [1+D/L)/(1-D/L)]$ where $K = k_D/k_L = 1$

For the first 200 hours experiment results $k_L = 0.010 \pm 0.001$ (95%, 2 δ); being $K_L = 0.0008 \pm 0.002$ (95%, 2 δ), for the whole experiment time (ca. 1600 hours).

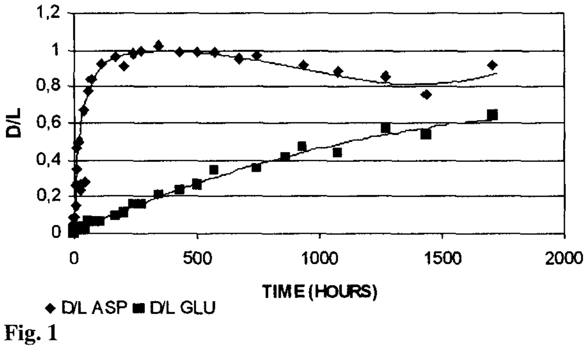

Fig. 1